

CLAIMS:

1. A video encoder (600) for encoding video signal data for an image slice comprising:

5 a slice prediction residual downsampler (645) adapted for selective coupling with the input of a transformer (650);

a quantizer (655) coupled with the output of the transformer (645); and

an entropy coder (695) coupled with the output of the quantizer (655),

10 wherein the slice prediction residual downsampler (645) is used to downsample a prediction residual of at least a portion of the image slice prior to transformation and quantization of the prediction residual.

2. The video encoder as defined in Claim 1, wherein the image slice comprises video data in compliance with the International Telecommunication Union, 15 Telecommunication Sector (ITU-T) H.264 standard.

3. The video encoder as defined in Claim 1, wherein the slice prediction residual downsampler (645) applies different downsampling operations for a horizontal direction and a vertical direction of the prediction residual. 20

4. The video encoder as defined in Claim 1, wherein downsampling resolution used in the slice prediction residual downsampler is signaled by parameters in the image slice.

25 5. The video encoder as defined in Claim 1, wherein the image slice is divided into image blocks, and a prediction residual is formed subsequent to an intra prediction for the image blocks.

6. The video encoder as defined in Claim 5, wherein the intra prediction is 30 performed using one of 8x8 and 32x32 prediction modes.

7. The video encoder as defined in Claim 1, wherein the image slice is divided into image blocks, and a prediction residual is formed subsequent to an inter prediction for the image blocks.

8. The video encoder as defined in Claim 1, wherein the slice prediction residual downsampler (645) applies a downsampling operation to only one of a horizontal direction and a vertical direction of the prediction residual.

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9. The video encoder as defined in Claim 1, wherein the image slice is divided into macroblocks, and a reference index coded for an individual macroblock corresponds to whether the prediction residual for that individual macroblock will be downsampled.

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10. The video encoder as defined in Claim 1, wherein the video signal data corresponds to an interlaced picture, the image slice is divided into image blocks, and the slice prediction residual downsampler (645) downsamples the prediction residual in one of a same mode as a current one of the coded image blocks, the same mode being one of a field mode and a frame mode.

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11. A video encoder for encoding video signal data for an image, the video encoder comprising:

macroblock ordering means (602) for arranging macroblocks corresponding to the image into at least two slice groups; and

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a slice prediction residual downsampler (645) for downsampling a prediction residual of at least a portion of an image slice prior to transformation and quantization of the prediction residual,

wherein said slice prediction residual downsampler is utilized to receive at least one of the slice groups for downsampling.

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12. A video decoder for decoding video signal data for an image slice, the video decoder comprising:

a prediction residual upsampler (715) for upsampling a prediction residual of the image slice; and

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a combiner (720) for combining the upsampled prediction residual with a predicted reference.

13. The video decoder as defined in Claim 12, wherein the image slice comprises video data in compliance with the International Telecommunication Union, Telecommunication Sector (ITU-T) H.264 standard.

5 14. The video decoder as defined in Claim 12, wherein the image slice is divided into macroblocks, and the video decoder further comprises Reduced Resolution Update (RRU) mode determining means connected in signal communication with prediction residual upsampler and responsive to reference indices at a macroblock level for determining whether the video decoder is in an RRU
10 mode, and wherein a prediction residual for a current macroblock is upsampled by said prediction residual upsampler to decode the current macroblock.

15 15. The video decoder as defined in Claim 12, wherein the slice prediction residual upsampler (715) applies different upsampling operations for a horizontal direction and a vertical direction of the prediction residual.

16. The video decoder as defined in Claim 12, wherein the upsampling resolution used in the slice prediction residual upsampler is signaled by parameters in the image slice.

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17. The video decoder as defined in Claim 12, wherein the image slice is divided into image blocks, and the prediction residual is formed subsequent to an intra prediction for the image blocks.

25 18. The video decoder as defined in Claim 17, wherein the intra prediction is performed using one of 8x8 and 32x32 prediction modes.

19. The video decoder as defined in Claim 12, wherein the image slice is divided into image blocks, and the prediction residual is formed subsequent to an
30 inter prediction for the image blocks.

20. The video decoder as defined in Claim 12, wherein the slice prediction residual upsampler (715) applies an upsampling operation to only one of a horizontal direction and a vertical direction of the prediction residual.

21. The video decoder as defined in Claim 12, wherein the image slice is divided into macroblocks, and a reference index coded for an individual macroblock corresponds to whether the prediction residual for that individual macroblock will be
5 upsampled.

22. The video decoder as defined in Claim 12, wherein the video signal data corresponds to an interlaced picture, the image slice is divided into image blocks, and said slice prediction residual upsampler (715) upsamples the prediction
10 residual in one of a same mode as a current one of the coded image blocks, the same mode being one of a field mode and a frame mode.

23. A method for encoding video signal data for an image slice, the method comprising the steps of:
15 downsampling (825) a prediction residual of the image slice;
transforming (830) the prediction residual; and
quantizing (830) the prediction residual, wherein the step of downsampling (825) is performed prior to the transforming or quantizing steps.

20 24. The method as defined in Claim 23, wherein the image slice comprises video data in compliance with the International Telecommunication Union, Telecommunication Sector (ITU-T) H.264 standard.

25 25. The method as defined in Claim 23, wherein said downsampling step (825) comprises one of the steps of respectively applying different downsampling operations for a horizontal direction and a vertical direction of the prediction residual or applying a downsampling operation to only one of the horizontal direction and the vertical direction.

30 26. The method as defined in Claim 23, wherein a downsampling resolution used for said downsampling step is signaled by parameters in the image slice.

27. The method as defined in Claim 23, wherein the image slice is divided into image blocks, and the prediction residual is formed subsequent to an intra prediction for the image blocks.

5 28. The method as defined in Claim 27, wherein the intra prediction is performed using one of 8x8 and 32x32 prediction modes.

29. The method as defined in Claim 23, wherein the image slice is divided into image blocks, and the prediction residual is formed subsequent to an inter
10 prediction for the image blocks.

30. The method as defined in Claim 29, wherein the inter prediction is performed using 32x32 macroblocks and 32x32, 32x16, 16x32, and 16x16 macroblock partitions or 16x16, 16x8, 8x16, and 8x8 sub-macroblock partitions.
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31. The method as defined in Claim 23, wherein the image slice is divided into macroblocks, and the method further comprises the step of determining whether the prediction residual for an individual macroblock will be downsampled based on a reference index coded for that individual macroblock, the reference index
20 corresponding to whether or not the prediction residual for that individual macroblock will be downsampled.

32. The method as defined in Claim 23, wherein the image slice is divided into macroblocks, and the method further comprises the step of flexibly ordering the
25 macroblocks in response to parameters in a picture parameters set.

33. The method as defined in Claim 23, wherein the video signal data corresponds to an interlaced picture, the image slice is divided into image blocks, and said downsampling step (825) downsamples the prediction residual in one of a same mode as a current one of the image blocks, the same mode being one of a field mode
30 and a frame mode.

34. A method for decoding video signal data for an image slice, the method comprising the steps of:

upsampling (925) a prediction residual of the image slice; and
combining (930) the upsampled prediction residual to a predicted reference.

35. The method as defined in Claim 34, wherein the image slice comprises
5 video data in compliance with the International Telecommunication Union,
Telecommunication Sector (ITU-T) H.264 standard.

36. The method as defined in Claim 34, wherein the image slice is divided
into macroblocks, and the method further comprises the step of determining whether
10 the video decoder is in a Reduced Resolution Update (RRU) mode in response to
reference indices at a macroblock level, and wherein said upsampling step comprises
the step of upsampling a prediction residual for a current macroblock to decode the
current macroblock.

37. The method as defined in Claim 34, wherein said upsampling step (925)
comprises one of the steps of respectively applying different upsampling operations
for a horizontal direction and a vertical direction of the prediction residual or applying
an upsampling operation to only one of the horizontal direction and the vertical
direction.

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38. The method as defined in Claim 34, wherein an upsampling resolution
used for said upsampling step is signaled by parameters in the image slice.

39. The method as defined in Claim 34, wherein the image slice is divided
25 into image blocks, and the prediction residual is formed subsequent to an intra
prediction for the image blocks.

40. The method as defined in Claim 39, wherein the intra prediction is
performed using one of 8x8 and 32x32 prediction modes.

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41. The method as defined in Claim 34, wherein the image slice is divided
into image blocks, and the prediction residual is formed subsequent to an inter
prediction for the image blocks.

42. The method as defined in Claim 41, wherein the inter prediction is performed using 32x32 macroblocks and 32x32, 32x16, 16x32, and 16x16 macroblock partitions or 16x16, 16x8, 8x16, and 8x8 sub-macroblock partitions.

5 43. The method as defined in Claim 34, wherein the image slice is divided into macroblocks, and the method further comprises the step of determining whether the prediction residual for an individual macroblock will be upsampled based on a reference index coded for that individual macroblock, the reference index corresponding to whether or not the prediction residual for that individual macroblock
10 will be upsampled.

 44. The method as defined in Claim 34, wherein the video signal data corresponds to an interlaced picture, the image slice is divided into image blocks, and said upsampling step upsamples the prediction residual in one of a same mode as a
15 current one of the image blocks, the same mode being one of a field mode and a frame mode.